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Chronic non congestive glaucoma: with special emphasis on therapy

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WITH

ESPECIAL EMPHASIS ON THERAPY

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INTRODUCTION AND HISTORY

It is my intention herein to discuss chronic non-congestive glaucoma only briefly as an entirety, so that a suitable back ground may be constructed for the more exhaustive perusal of the recent literature on the therapy in that particular type of glaucoma.

Throughout this paper the terms chronic non-congestive glaucoma, simple glaucoma and glaucoma simplex will all refer to the same condition.

The term glaucoma is not the title of any one single disease but is a clinical label for a complex of symptoms.

Over four centuries before the Christian era, Hippocrates described glaukos as among the known affections of the eye. The Greek word, glaukos, he used to describe the disease because he saw a gray green reflex from the pupil. The word means gleaming or bluish gray.

The Greeks and Latins, who followed, spoke of those causes giving rise to blindness and not aided by operation as glaucomata.

The discovery of the ophthalmoscope in 1851 by Helmholtz aided in the recognition of simple glaucoma. Adolph Weber made the clinical discovery of the cupping of the disc. Danders noted that simple glaucoma was but another form of glaucoma unaccompanied by inflammatory symptoms. He

thought the increased tension was due to irritation of the secretory nerves of the eye.

Mac Kenzie in 1830 wrote that the daily use of belladonna was beneficial to vision in glaucomatous eyes. Von Graefe later noted its harmful effects.

Laqueur of Strasburg in 1876 introduced the use of miotics in the treatment of glaucoma.

MacKenzie maintained that the hardness of eyes in glaucoma was due to overfilling of the globe with fluid and suggested paracentesis of the aqueous or of the vitreous chamber. Lebers classic work however established the secretion of the intra-ocular fluid by the ciliary body.

Max Knies and Adolph Weber discovered the important fact of the closure of the angle of the anterior chamber by the adhesions of the iris to the base of the cornea.

Bowman introduced the finger tip method of taking intra-ocular tension.

Von Graefe discovered the valuable use of the iridectomy in congestive cases but he also ruled outside a number of cases which today we unhesitatingly put in the simple glaucoma group. Elliot (5) says, "Von Graefe evidently confused simple glaucoma with cases of optic atrophy with shallow cupping of the nerve head".

De Wecker first realized the value of the filtering scar. Heine developed the cyclodialysis operation in 1905 and Lagrange the sclerotomy in 1906. All the modern filtration operations are based on the latter.

ETIOLOGY AND PATHOLOGY

The etiology and pathology of primary glaucoma is not entirely understood. In 1879 Priestly Smith stated that narrowing of the cercum lenticular space is the chief factor in the causation of glaucoma.

Gradle, according to S. H. Long (30), says, "There are three factors which may cause an attack:

1. An anatomic structure that will allow the chamber angle to become closed.
2. A lack of tone of the sympathetics that control the ocular vessels.
3. A sudden rise of blood pressure."

S. R. Gifford (11) states, "A glance at the conflicting opinions shows that the classic view of glaucoma and the physiology of the intra-ocular fluids as is at present taught in most schools is too simple to account for all the clinical and experimental facts observed. Evidence is accumulating that the aqueous is not a secretion but a dialysate of the blood and hence the vascular disturbance is of great importance in the production of glaucoma. The part blood chemistry plays is still a question. The swelling of the vitreous and low grade infections are factors".

Some of the predisposing causes in the production of glaucoma are history of heredity, arterialsclerosis and cardiac disease, chronic constipation, gouty and

rheumatic diathesis. Some of the exciting causes are emotions, especially depressions, insomnia, worry, injudicious use of atropine, overuse of ametropic eyes, insufficient food, overeating, indigestion, fever, influenza, etc.

SYMPTOMATOLOGY

The symptomatology of simple glaucoma was taken in a great part from Charles H. May's (31) manuel of the diseases of the eye.

This type of glaucoma is of gradual development with an absence of any marked external symptoms. There is no pain and no congestive attacks. Hence the term, chronic non-congestive glaucoma.

There may however be a slight circumcorneal injection and a sluggish pupil, moderately dilated. The tension is often slightly elevated but the elevation above normal is not constant.

A therepeutical test is the instillation of adrenalin. This drug often produces mydriasis in glaucomatous eyes but does not effect the size of the pupil in a normal eye.

The patient may complain of foggy vision, colored halos about artificial lights and diminished accomodation.

There is a gradual loss of vision and premature presbyopia. The light sense is reduced and a progressive contraction of the visual field, especially on the nasal side occurs. Roenne's nasal step, a sharp right angled

defect of the nasal field is often present. The color field reduction corresponds to that of the form field.

Scotomas are common and may be peripheral, paracentral, and in the final stages central. The blind spot is often enlarged by tapering wing-like extensions upwards or downwards or in both directions. Central vision is the last to be lost.

After the disease has progressed a short time, the ophthalmoscope shows glaucomatous excavation and atrophy of the optic nerve and a circumpapillary ring of choroidal atrophy.

This desease is insidious and lasts for years. If unchecked it terminates in blindness. This chronic non-congestive type of glaucoma may change to the chronic congestive type and go through all the stages of that disease.

THERAPY

Chronic non-congestive glaucoma should be managed rather than treated. The patients vision can only be conserved by taking the case over completely and giving him constant supervision the rest of his life just as the internist does with the sufferers of heart disease, hypertension, diabetes, tuberculosis, etc. In the majority of cases this type of glaucoma does not require emergency attention. A competent internist should go over the

patient and attempt to cure or control any other pathology present. Particular attention should be paid to foci of infection and any source of focal infection, if found, promptly erradicated. Constipation should be corrected and an adequate non-stimulating diet prescribed in order to build up resistance. The patient should avoid as far as possible fatigue and exhaustion and attempt to control the emotions, expecially worry, grief, anxiety and excitement. Moderation should be the rule in the use of alcohol and tobacco. Being in the light and reading produce miosis and are, therefore, aids to treatment and should be encouraged.

The tension of an eye can usually be quickly reduced by massage. Tactile massage can be carried out by placing the tips of the two index fingers on the upper lid over the globe and making pressure with each finger towards the center of the eye. The movements are slow at first and later become more rapid. The length of treatment should not at first exceed one half minute, later it may be made to last as long as three to five minutes. The patient quickly acquires the knack of tactile massage and may be allowed to employ it as often as three times a day at home. Instrumental massage may be employed but has the disadvantage of the machine frequently getting out of order due to the numerous fine moving parts, and, also, the patient could not, himself, use this type of massage at

home. Suction massage has been used. In this type, elliptical cups are employed, the air being exhaused in them at each respiration of the patient. From fifty to two hundred tractions may be given at a sitting. Domec, according to Elliot (5), says, "This form of massage produces analgesia by putting traction on the ciliary nerves and reducing intra ocular pressure".

Antiphlogistic treatment has no use in thie type of glaucoma. It is applicable only to congestive conditions.

Most observers including de Schweinitz are very doubtful of the value of the use of electricity and diathermy in reducing intraocular tension. It is, however, said by some that high frequency currents are capable of reducing both arterial and ocular pressures. I could find no experimental or clinical data on this.

R. I. Lloyd (29), says, "I have tried X-ray treatment a few times in glaucoma simplex and am in doubt whether it does any good. I have seen, however, no ill effects".

Lambert and Wolff (28) say, "There is no doubt that the intravenous injection of a hypertonic solution will always produce a drop in ocular tension. The drop in normal individuals is short lived, in glaucoma it is more protracted. It is not a curative agent producing a permanent drop in tension unaided by other measures".

Duke Elder (4) advises the use of a 30% hypertonic sodium chloride solution.

Elliot (5) says, "Saline solution as a subconjunctival injection has found very few advocates and these do not seem to be very whole hearted". According to Elliot, Thomas gives sodium carbonate and sodium chloride and two tablespoonfuls of sodium bicarbonate per the rectum. Weeker administers fifteen grains of calcium chloride three times a day orally for months at a time. Sansun has employed intravenous injections of glucose and obtained striking reductions in ocular tension. Elliot states, "More harm than good may come to the glaucomatous patient by lowering the general vascular pressure". He gives no reason as to why he drew this conclusion.

Gradle (16) says, "The treatment of non-inflammatory glaucoma is in a majority of cases not an immediate emergency. The treatment must be based on symptoms and the way they are influenced by treatment". The principle criteria being the tension, vision and fields. The same authority goes on to say, "If the disease is in a comparatively early stage and if the visual fields are not down to a danger point regardless of tension we are not pushed for time and the case should not be operated on until it has been worked out thoroughly". He further recommends that the treatment be started with the time honored drug, Pilocarpine, $\frac{1}{2}$ to 1% b.i.d. to t.i.d. The patient should then be checked at frequent intervals, say once a week. The examination should be at the same time

each day as there is a definite curve of intraocular tension that varies during the day. The relationship of the time of instillation of the miotic to the time the patient is seen plays an important role. One should see that a definite interval elapses between the time of instillation and the time of examination, otherwise, minor variations may throw ones records off. The influence of the miotic on tension is rapid and will soon show the affect of the drug in clearing the condition. The visual fluid changes are slow and, therefore, the visual fields need not be taken oftener than every two to three weeks. If observation of the tension vision and fields indicates that the glaucoma symptoms are increasing despite Pilocarpine, increase the strength of the solution to 2%. If at that strength pilocarpine does not check the increasing symptoms a weak solution of eserin, ¼ to ½%, must be resorted to. Gradle (16), however, says, "A case that requires eserine is not a non-operative case". Authorities, however, vary. Wright (40) says, "The best non-operative method of treatment is the effective instillation of eserine". S. R. Gifford (12) says, "In nearly every case miotics should be tried before anything else is done; at the onset pilocarpine nitrate 1% should be used. If this does not control the tension, eserine salicylate 0.2% should be employed". Gradle later in the same article as his above quotation seemed to refutiate his statement about eserine

by saying that "if eserine will not hold the triad of symptoms quiesent, we still have other resources left before operating". He then goes on to mention the use of the adrenalin pack which will be discussed later.

Snyder (37), in his paper on the treatment of glaucoma says, "If the patient responds readily to miotics and the form field does not decrease and the tension is kept within normal limits and you have found some general cause which you are able to correct, I think you are justified in waiting before suggesting operation. But if the patient is careless, inclined to neglect instructions or you do not find a general cause, then recommend operation."

According to Elliot (5), de Wecker in discussing the medical treatment of glaucoma versus the surgical treatment said, "If miotics have never cured a case of glaucoma they have prevented many glaucomatous patients from being cured". Fuchs (8) says in discussing miotics that, "they are effective only as long as they narrow the pupil adequately. In old cases with atrophic iris they are useless". Parsons (33), in discussing the indications for the use of miotics in chronic non-congestive glaucoma, states,"if vision is reduced almost to the fixation point operation will do no good but may result in sudden, complete loss of vision".

Elliot (5) advises the use of miotics as a preparation for operation. He stresses the instillation of the miotic drug the last thing at night. He prefers the salicylate of eserine to the sulfate and the nitrate of pilocarpine to the chloride.

Rutherford (36) advises the use of pilocarpine early as it is less irritating. He says that eserine often causes conjunctivitis.

Goldenburg (15) says, "Eserine as a rule is not well tolerated over a long period, pilocarpine acts more favorably and a combination of these two acts favorably where tension is high and the individual drugs have lost their potency".

Stokes (38) says of miotics, "In glaucoma, if pilocarpine will produce the physiologic effect desired of a miotic, eserine should not be used but should be held in reserve, it is only a question of time until the solution employed will lose its effect. Therefore, it should be the rule to start with the weakest solution of pilocarpine which will produce the result wanted: when it no longer suffices a stronger solution is ordered. The possibilities of pilocarpine being exhausted eserine is resorted to, and its strength increased as needed. By these means a patient with chronic simple glaucoma, and who declines an operation may be carried along for years

maintaining vision and field and keeping the tension within normal limits. The sulfate is thought to be more potent in its effect than the salicylate, but it also produces more discomfort. When exposed to light eserine turns red, its activity is in no wise affected by the change in color".

Pilocarpine stimulates the endings of the parasympathetic nerves while eserine (physostigmine) also stimulates the peripheral endings of the parasympathetic nerves and probably in addition acts directly on the musculature.

These miotics, when used locally in the eye, cause contraction of the sphincter muscle of the iris. This opens the angle of the anterior chamber, increases the surface of absorption presented by the iris and in this way reduces intra-ocular tension.

Draier was the first to point out the tension lowering effect of epinephrine on the eye and in 1914 Erdmann first used epinephrine subconjunctivally in cases of glaucoma. In 1922 Carl Hamburger advocated the use of suprarenin and in attempting to eliminate the occasional unfavorable epinephrine reaction, developed synthetic levoglaucosan or glaucosan which will be discussed later.

Epinephrine when instilled in the eye or injected subconjunctivally produces mydriasis, a lowering of intra-ocular tension and frequently systemic effects, which are very distressing and undesirable.

Parker (32) treated twelve patients by means of subconjunctival injections of epinephrine. In all the cases the tension was reduced temporarily but the treatment only proved beneficial in one case.

Adrenalin or epinephrine is of great use in restoring the strength of miotics which even though used in irritating concentrations have apparently lost their action.

Gradle (16) felt that even though eserine and pilocarpine failed to check the glaucomatous process there should remain other forms of treatment before operation was resorted to. He, therefore, advocated the use of the adrenalin pack. This consisted of a small pledget of cotton soaked with four or five minims of adrenalin and placed in the upper cul de sac for four or five minutes. An anesthesia such as Butyn must, however, be used before the pack is placed in the cul de sac.

Wright and Nayar (40) say, "In chronic glaucoma the adrenalin pack is of the greatest use. It will sometimes almost dramatically reduce tension where intensive eserine treatment or other combinations have failed. It has the tendency to at first increase the tension. This increase of tension may not, however, occur if the tension is only moderately increased, and may be prevented by the frequent instillation of eserine. The fall may reach its maximum in two to three days. This fall may be also

prolonged by the use of eserine. The pack may, therefore, be used to give eserine a start and to allow it to exert its maximum effect. When the tension again starts to rise in spite of miotics there is no reason why the pack should not be repeated".

The use of miotics to prevent an acute rise of tension when employing the adrenalin pack was brought out by Gifford (12). He uses 0.2% eserine every twenty minutes for the first hour and every half hour for the next two hours. In employing the adrenalin pack in fifty cases he found that in forty-two of them the tension went below twenty-five millimeters of mercury as recorded by the Schiotz tonometer. The average decrease was ten millimeters of mercury. In thirteen cases the tension was kept within normal limits for one week or more and in five cases for longer than one month and some for eight to twelve months. In all the vision remained the same as before treatment. Most of the cases, however, finally required operation. In two cases there was an acute rise in tension. This was apparently due to mydriasis and might have been prevented by the vigorous use of miotics before and after treatment. Gifford goes on to say that if the first treatment by adrenalin packs is ineffective nothing can be gained by further attempts to use it.

Hamburger (22) in working with epinephrine found that in glaucoma simplex good vision and good visual

fields could be preserved for years even where miotics had entirely lost their effect. He was, however, inconvenienced by the troublesome increase in the systemic blood pressure. This he knew to be due to laevogyrate suprarenin as dextrogyrate suprarenin has a local constricting effect without in any way effecting the blood pressure. Hamburger using this knowledge as a basis developed glaucosan by combining dextrogyrate suprarenin with the inactive preceding stage of this preparation called methylaminoacetolrenzkotechin. This preparation he found could be injected subconjunctivally without any increase in blood pressure. The glaucosan drops which Hamburger also developed were of a much higher concentration of the solution plus laevogyrate suprarenin. These produced dilated pupils and softening of the eye, enlargement of the lid opening and palor of the skin under the eyelid. Softening of the eye, however, was not always constant as many acute rises in tension followed the instillation of the drops. Gifford recommended the use of physostigmine before and after the use of glaucosan. This procedure has proved very efficient in combating acute rises in tension. Hamburger is very exacting in his technique of instilling glaucosan. Two drops are put in the nasal corner of the closed eye. They the lids are carefully opened by the oculist and the patient caused to move his eyes from side to side. He repeats this process

from four to five times at quarter hour intervals. He finds that the effect may last for weeks.

Green (19) has used laevoglaucosan in a number of cases of glaucoma simplex and believes it to be a valuable adjiwant to miotics. He found it not to be universally successful in reducing tension and admitted some failure. He enumerates the draw backs to the use of glaucosan as follows:

1. It is furnished in small amounts in ampuoles of which most of it is spilled even when great care is observed.
2. As a mydriatic it causes a whitish granular deposit on the cornea veiling and distorting the ophthalmoscopic picture.
3. The price is nearly prohibitive.
4. It must be used continuously to be effective.

Duke Elder and Law (4) also conclude that laevoglaucosan cannot be depended on to lower tension. "It does in some and fails in others. It appears that in conjunction with eserine a good effect can be secured where eserine alone failed. Both drugs are accompanied by severe pain and reaction".

Elliot, according to Chattin (1) used laevoglaucosan (Linksglaucosan) in simple glaucoma. In five of his cases the tension was lowered transitorily, one case was benefitted but in no case was the tension permanently lowered by the use of glaucosan alone.

Parker (32) used Linksglaucosan on nine patients and in none was the tension satisfactorily reduced.

Wright (40) says "our observations on glaucosan and aminoglaucosan caused us to draw some unfavorable conclusions".

Aminoglaucosan was also developed by Hamburger. It is of use only in acute glaucoma.

Post (34) ran a series of cases of glaucoma using laevoglaucosan and epinephrine. He concluded that this combination is an important aid in the non-operative treatment of chronic simple glaucoma, of little value in secondary glaucoma and of no value in acute glaucoma. "The primary action of laevoglaucosan and epinephrine bitartrate in chronic simple glaucoma is due to induced anemia in the vascular bed. The prolonged lowered tension is probably due to a temporarily improved metabolism of the eye". A typical case from Post's series follows:

> "White male aged 70 years. Left eye blind. Right field reduced to 20°. After an iridectomy the tension remained 30-40 millimeters of mercury under strong miotics. The patient refused further operation. Epinephrine bitartrate and pilocarpine in reduced strength was prescribed. Epinephrine being used every fourth day. Tension has been 17 millimeters mercury for the past 3 months."

Green (19) reported a series of fifteen cases of simple glaucoma using as therapy 2% suprarenin bitartrate which is laevorotatory epinephrine. He obtained:

1. Mydriasis of various degree.
2. Ischemia of the conjunctiva.
3. Lowering of tension--there were exceptions.
4. Absence of systemic effects.
5. No white granular deposits on the cornea.
6. Some burning or pain on instillation which soon passed off.

Thiel and others according to Gifford (10) have used ergotamine (trade gynergen) in the treatment of glaucoma. Such a drug causes the uterus to contract, blood pressure to rise, etc. The drug also usually decreases the permeability of vessels. Thiel kept the tension normal in glaucomatous eyes over long periods of time by twice a day injections or oral administration of two to three grains of ergotamine. Miotics which had become ineffective also again became effective. He found, however, that the numerous injections were impracticable, the oral doses were not constant in action and the cost was nearly prohibitive.

Tyramin is also a derivative of ergot and has in many ways an effect opposite to that of histamine. There is a vasoconstriction and a sympathetic stimulation. The latter of course causes the pupil to dilate. The effect,

however, of tyramin on increased intraocular pressure is nihil but when it is combined with histamine five parts to one of tyramin a fall of intraocular pressure is effected. This fall of tension is even greater than that produced by adrenalin. One-tenth and five-tenths cubic centimeters is injected subconjunctivally to produce the result. Of course numerous subconjunctival injections are impracticable and, therfore, tyramin will probably not come into wide usuage.

Calcium has also been experimented with, in the treatment of glaucoma. Pharmacologically calcium decreases the permeability of capillaries and so prevents oedema. Weeks in 1912 gave calcium 3 grains per day orally and found he could control miotic resisting cases. The effects were not, however, constant. Von Hofe reports the use of calcium chloride and adrenalin produces a fall in intraocular tension greater than adrenalin alone.

Pituitrin and barium are being used experimentally on animals that have artifically increased intraocular tensions but the results are not as yet published. No reports of the use of pituitrin and barium on glaucomatous eyes are at hand.

Surgery is, of course, of extreme importance in the treatment of chronic non-congestive glaucoma. It is my intention herein to bring to the front, the views of several ophthalmalogists on when operation should be

performed on this type of glaucoma and when operation should not be performed and why. Concerning the actual technique of the various operations much time and space could be given to the different procedures. I, however, do not believe this necessary. Anyone doing actual operative work should consult the leading authorities on such. The procedures of the operations will be only briefly outlined in order to give sufficient background so that the various underlying therepeutical principles can be better understood.

As has been said before, the best criteria as to whether or not a certain treatment is holding the glaucomatous process in check are the fields, tension and vision.

If the tension cannot be held within normal limits with the various medical procedures and the field of vision continues to decrease, most ophthalmologists agree that the time has come for operative interference even though the central vision remains good.

Some ophthalmologists are even bolder. Gifford (12) states, "Medical treatment should be regarded as temporary and of use only where operation has to be delayed. The danger is that the operation may be delayed too long".

Rutherford (36) says, "Most men are agreed that surgical intervention is the only rational treatment for glaucoma".

Parsons (33) advises operation as soon as the condition is definitely diagnosed. He stresses the importance of the field of vision as a guide in doubtful cases.

The type of individual being dealt with also has to be considered. If the patient is intelligent, cooperative and is so located that frequent examinations can be done, surgery need not be so strongly insisted upon. If, on the other hand, the individual is of low mentality, does not cooperate or lives at such a distance that adequate supervision cannot be had, operation should be absolutely insisted upon, providing of course, some contraindication to operation does not exist. These will be discussed later.

Other ophthalmologists are more conservative. Gradle (16) operates when chronic non-congestive glaucoma gets just beyond the control of miotics. Jervey (24) says, "As long as you can keep a patient without pain, loss of acuity of vision, loss of field or excessive tension you should not operate". Elliot (5) states, "The moment non-operative treatment shows evidence of failing to hold the disease in check, the time has come for surgical interference". As has been said before Snyder (37) does not suggest operation as long as the patient responds readily to miotics, and the form field does not decrease, and the tension is kept within normal limits. Parker (32) does not advise operation if he believes that the simple glaucoma is

being caused by a swollen lens in the initial formation of cataract. He has found that the patient often spontaneously recovers from the glaucomatous process if due to cataract formation.

Post (34 says of contraindications for operation, "In glaucoma simplex there are not often substitutes for operation, but there are always cases in which surgical intervention is inadvisable. For example, old age, ill health, disinclination of the patient or apprehension of the surgeon because of a greatly restricted field of vision in an only remaining eye".

Another very definite contraindication to operation according to Parsons (33) is the reduction of vision in an eye to the fixation point. "Here" he says, "operation will do no good but may result in sudden loss of vision".

Von Graefe (18) who first applied the iridectomy to the treatment of glaucoma said "in chronic glaucoma iridectomy was followed by improvement later deterioration". His pupil, de Wecker, was however, according to Elliot, a firm believer in iridectomy for simple chronic glaucoma, as well as for the acute congestive type. He sent out questionaires to 112 surgeons asking their opinions as to the results they were getting in the treatment of simple glaucoma by means of iridectomy. Of these, 74 or 66% had a low opinion as to the value of the method, 20 or 17.85% were non-committal and 18 or 16% were in favor

of the operation. De Wecker, however, held firmly to his convictions and it was not until 1867 that he proposed sclerotomy for chronic glaucoma.

Elliot (15) says, "I have never observed any special curative action of iridectomy in amaurosis with excavation of the optic nerve".

Fuchs (8) states in his diseases of the eye, "The iridectomy has as an object, the combating of peripheral synechia and opening of the natural outflow passage in Schlemm's canal. Its effectiveness in glaucoma simplex is less and not so permanent. It does not relieve the disturbance of vision because this disturbance is due to anatomic changes in the optic nerve head. At best it combats elevation of pressure and stops further progress of the disease. Destruction of vision may go on even though the pressure is normal. The optic atrophy once started pursues its further course even with normal pressure. In the opinion of writers iridectomies give about 50% results. The earlier the iridectomy the more favorable is the outcome". Fuchs (8) did an iridectomy on 39 cases. There were 19 good results in which vision remained stationary and 20 miscarriages. Robertson (35) says, "The elder Fuchs advised iridectomy. Up to 1908 he had few bad results. Adalburt Fuchs does not like iridectomies or the Lagrange operation because of oblique astigmatism.

Parsons (33) in discussing iridectomy as a surgical measure in the treatment of glaucoma simplex states, "Iridectomy was the operation of choice until a few years ago. It is not so good because the periphery of the iris is often firmly adherent to the corneasclera before the condition is diagnosed and because the iris frequently tears at a false angle. The iridectomy did, however, frequently succeed by establishing a filtering scar, thru which the intravascular fluid was able to make its way into the subconjunctival tissue where it was absorbed". He goes on to say that a broad iridectomy if performed early has a better prognosis than when done later.

Gifford (12) and Snyder (37) do not believe iridectomies to be of much value in chronic simple glaucoma.

Thompson (39) believes that iridectomy only has effect on chronic simple glaucoma when the wound healed imperfectly or a filtering cicatrix was formed.

Rutherford (36) says, "In the non-congestive type of glaucoma an iridectomy is indicated where the anterior chamber is deep. There, however, is no assurance of success".

Knapp (26) attempted iridectomy in twelve cases of simple glaucoma. The tension was permanently reduced in five cases. There were seven recurrences. In two of the

recurrences trephining was carried out. It was successful in one and failed in one. The iridectomy was carried out in very early cases especially in cases whose tension was easily reduced with miotics.

Parker (32) does an iridectomy in chronic simple glaucoma under the following conditions:

1. Moderately deep anterior chamber.
2. Fields not markedly contracted.
3. Iris not atrophic.
4. Cases showing variable tension after miotics.

In 63 iridectomies the tension was reduced from 5-20 millimeters of mercury. On 9 failures Parker did a trephine operation with 4 failures and 5 good results.

Let me say that it is apparent that if iridectomy is indicated at all in the treatment of chronic non-congestive glaucoma, the cases should be carefully selected. Only those should have this type of operative procedure that have fields that are not markedly contracted, good vision say 20/30, tension not well controlled by miotics and a moderately deep anterior chamber.

According to Elliot (5), de Wecker in 1867 proposed sclerotomy for chronic glaucoma. The cicatrix of which facilitated the filtration of aqueous. Dionaux reaffirmed its value.

Technique: a narrow Graefe knife is made to puncture

the sclera one millimeter to the temporal side of the limbus and about two millimeters below the highest part of the corneal circumference. It is carried on through the anterior chamber to emerge at a corresponding point on the nasal side. Eserine should be used before and after operation.

This operation failed to give the satisfaction it promised. Although some cases may have been healed by it, an iridectomy usually had to be resorted to. "At present" according to Fuchs (8)"operators only do sclerotomies where iridectomies are technically impossible". The anterior sclerotomy wound although not supposed to heal usually does and the relief given is only temporary. This operation has the advantage that the cornea is not injured.

Posterior sclerotomy which is a technically different operation has no place in chronic non-congestive glaucoma therapy. Its greatest use is in absolute glaucoma.

Lagrange in his work with chronic glaucoma found that the usual operations on glaucoma with low tension were nearly valueless. He, knowing that those cases in which a filtering cicatrix had been formed unintentionally had the tension lowered even though it had not been much above normal before the operation, investigated the filtering cicatrix of scleratomies and iridectomies. This

revealed that such cicatrices were caused by involvement of iris in the wound. Lagrange then set out to produce an iris free filtering cicatrix. This he accomplished in 1906 by means of a sclerecto-iridectomy.

This operation did not include the iris in the wound but obtained a filtering cicatrix by preventing the lips of the wound from coming into good apposition by removing a corneal lip of the wound with scissors and allowing the gap to become filled with loose scar tissue.

The technique is as follows according to Elliot (5):

Lagrange used a narrow Graefe knife to make a small corneoscleral flap above, "A puncture and counter puncture are placed each one millimeter outside the corneal margin and the blade is carried upward parallel to the iris and as close to it as possible. The first object being to sever the scleral insertion of the ciliary muscle. The plane of the knife blade is then changed so that it emerges from the sclera 2-3 millimeters from the limbus and thus bevels the posterior lip of the incision. The incision is completed by making a large conjunctival flap. This flap having been turned down, the corneal lip of the wound is removed with scissors. If iridectomy is considered desirable it is done at this stage and the replacement of the conjunctival flap completes the operation".

Thompson says of the Lagrange operation, "It is alsoa valuable operation in chronic cases but not in my opinion as valuable as the trephine. In several instances I have seen the Lagrange wound close up while a closure in the trephine wound is rare". Snyder (37) says the Lagrange operation is a very difficult one to do successfully.

Knapp (26) used the Lagrange operation in 95 of his series of 200 operations for chronic simple glaucoma. He had success in 85 of the 95. In 10 cases, drainage by filtration was not re-established and tension returned. In 2 of the 10 showing return of tension he successfully accomplished a trephine and in one a cyclodialysis but without a permanent result. Knapp reserved the Lagrange operation for selected cases. They were all early, had good fields, irises of good texture and the tension could be lowered to below 35 millimeters Schiotz with miotics. Those cases not fulfilling these requirements he trephined. Knapp says, "After the Lagrange operation the anterior chamber restores itself earlier, the pupil dilates better, the filtering area is smaller and the conjunctival protection is better than after trephining".

Herbert devised an operation of wedge isolation for chronic non-congestive glaucoma. He attempted to cut out a wedge or prism shaped piece of cornea-sclera. The long axis was tangential to the corneal margin and its base attached to the under surface of the conjunctiva and its

edge towards the posterior surface of the cornea. The isolated wedge was supposed to be raised by escaping fluid and to shrink sufficient to provide for filtration. This operation did not meet with approval probably because of inherent technical difficulties.

Fergus in 1909 devised a sclerotomy operation using a trephine. Briefly the technique was as follows: A conjunctival flap is dissected up towards the cornea and laid over the corneal surface. With a trephine a small disc of sclera one or two millimeters in diameter is removed from the apparent corneal margin. An iris repositor is passed from the trephine hole into the anterior chamber. The conjunctiva is then replaced and stitched into position. This operation apparently did not meet the approval of surgeons, as very few men reported cases on which they had used the Fergus method. Elliot (5) says, "The Fergus operation involves the opening of the suprachoroidal space to which is added a cyclodialysis".

The British surgeon, Elliot is a great admirer of Lagrange. He reasoned that the principles upon which Lagrange built his operation, the production of a filtering cicatrix without iris incarceration, were sound. Elliot did not, however, like the use of scissors in the procedure. In casting about for a better means of producing a sclerotomy he hit upon the trephine as used by Fergus and also found that a much better filtering cicatrix would be formed if the cornea was split for some little distance before employing the trephine. The

actual technique in brief is as follows: The patient is told to look down and a vertical fold of conjunctiva is grasped with forceps as high on the globe as possible, 9 to 10 millimeters. The conjunctiva is divided horizontally above the forceps. The conjunctival incision is then enlarged to the right and to the left with scissors so as to make a flap roughly concentric with the limbus. These cuts should come down on each side to a line drawn horizontally along the upper border of the cornea. The conjunctival flap is dissected down to within 4 to 5 millimeters of the cornea. The episclera is then incised horizontally and concentrically with the conjunctival incision. The dissection proceeds along the surface of the sclera to the limbus. This flap is now turned down over the cornea and the sclera is scraped with scissors. The cornea is then split for from one to two millimeters with short side to side motions. An attempt should be made to confine the splitting process to one level of corneal lamella. The trephine is then placed on the cornea and its cutting edge slid down so that at least half of the drill opening will be in the cornea. The handle of the trephine is rotated until the cornea is cut through. Care must be taken not to let the instrument enter the eyeball. The trephine is removed and the iris bulges into the hole. The presenting iris and the corneal disc should be grasped and both cut off with a single snip of the scissors. The conjunctiva and episcleral tissue

are smoothed out and carefully replaced and the cut edges of the conjunctiva united by two silk sutures.

Of course Elliot's corneoscleral trephine operation has justly enjoyed great popularity in the treatment of glaucoma. Consequently the ophthalmological literature does not lack case reports concerning the various surgeons success with this operation. Many oculists use it as a standard in judging other operative results and resort to it in case of failure in other surgical procedures.

Fuchs (8) says, "This operation, the scleral trephine of Elliot, is especially indicated in simple glaucoma. In practice this is best undertaken after the effectiveness of miotics has been determined. When the miotics have reduced the intraocular pressure in a significant way a trephine is in order instead of an iridectomy because the iridectomy will influence it only a little bit".

In Parker's (32) series, 76% of the trephine operations gave good results. On 15 a trephine operation after iridectomy failure, yielded 66% good results.

Greenwood (21) says, "I have come to feel, however, that the trephine operation is the surest operation that is done for chronic glaucoma". He found that none of his trephines have resulted badly. Greenwood, however, reserved this for non-congestive glaucoma with low tension.

Snyder (37) says, "Possibly the trephine is the best operation".

Thompson (39) states, "The trephine operation reduces tension to 10 to 12 millimeters mercury and keeps it there for a number of months. The trephine operation accomplishes the result better than any other operation. The disadvantage is the so called infection of the trephine opening".

Kirkpatrick (25) says, "I have definitely settled on Elliot's classical trephining. It seems to give the best results over a long period of time".

Knapp (26) found 60 of 80 of his trephine operations to be successful. In 20 cases the tension increased again and in 9 of 20 a second trephine was performed with success in 7 and failure in 2. He also trephined 2 Lagrange failures with success.

Rutherford (36) found "In chronic non-congestive glaucoma a corneoscleral trephine is proper where the anterior chamber is shallow".

Parsons (33) says, "Trephining is the operation which is now generally performed for chronic glaucoma. It is, however, uncertain and liable to be complicated with serious danger if vision is reduced almost to fixation. Complete blindness may even result. With incipient cataract and chronic glaucoma trephining induces a serious complication to subsequent extraction of the lens. It should, however, be done and when extraction of the lens is done later the section of the cornea is slightly anterior to the trephine hole".

In Elliot's (5) first 50 cases using the corneo-scleral trephine the tension was relieved in every case. He has personally performed well over a thousand trephine operations for the relief of glaucoma simplex and still is highly enthusiastic over the results he obtains.

Here are some typical comments on trephining as published by Elliot (6) in 1932. "The motive is to reach and tap subconjunctivally the anterior chamber with a minimum of injury to the structure of the eyeball. The iris is only dealt with in order to obviate any tendency it might have to block the trephine hole. Combining cyclodialysis with trephining is making a retrograde step. I believe that adhesions of uveal tissue to the cornea is the most fruitful source of failure after trephining. The iridectomy is merely a sluice gate which allows the aqueous to escape thru the trephine hole without danger of carrying the underlying iris with it. Physostigmine, 4 grains to the ounce, should be instilled one hour before operation and again just before operation. Removal of a definite area of Descmets membrane is an essential to the success of the operation".

Bjerrum recommended his operation for chronic non-congestive glaucoma in the event that miotics failed. This operation must not have stood the test of time as very little could be found concerning it, especially in the more recent literature. Bjerrum with a Graefe knife made an

incision, the puncture and counter puncture at the limbus, and the knife being made to cut out obliquely so that it emerged from the sclera from three to six millimeters from the upper or lower edge of the cornea.

A cyclodialysis operation was introduced in 1905 by Heine of Brislau for the control of simple glaucoma. Briefly his technique was as follows: With a straight lance knife an incision was made into the sclera parallel to the corneal margin and five to six millimeters outside that margin. A small spatula was then passed through the wound and between the sclera and uveal tract into the anterior chamber breaking through the ligamentum pectinatum. In this way he attempts to set up a communication between the anterior chamber and the suprachoroidal space.

Gradle (17) says of cyclodialysis in simple glaucoma, "This operation is not applicable to all forms of glaucoma nor even in all stages of simple glaucoma". Gradle used this operation on 27 selected cases. By selected he meant:

1. Cases of simple non-inflammatory glaucoma.
2. Those never having shown inflammatory exacerbations.
3. Those having been observed under miotics for one month or more.
4. Cases in which intraocular tension vision and fields failed slowly despite miotics.
5. Those watched for at least one post operative year.

Gradle's indications for cyclodialysis were:

1. Simple non-inflammatory type.
2. Type of simple just beyond the control of miotics.
3. High intra-ocular tension and visual fields extending within one degree or less of fixation.
4. Following a technically perfect iridectomy which has failed.

Of these 27 cases Gradle had failures in two cases or 7.4%, partial success in 4 cases or 14.8%, success in 21 cases or 77.8%, cataract formation in 3 cases or 11.1% and increase in vision of 10% or more in 6 cases or 22.2%.

Where proper indications exist Gradle prefered cyclodialysis to iridectomy or fistulizing operations because of:

1. Less damage to the integrity of the eye as a visual organ.
2. Less danger of immediate post operative complications.
3. No danger of late infection.
4. Possibilities of repetition if unsuccessful.

Knapp (26) in a series of operations for simple glaucoma used cyclodialysis after failure of a Lagrange operation without a permanent result. He also used a cyclodialysis operation on 4 cases following trephine failure without a permanent result. In 5 of 8 uncomplicated cases, cyclodialysis reduced the tension and in 3 failed to do so. Knapp says, "Cyclodialysis was done in those cases in which there was nervousness, myopia or extreme advance of the

glaucoma".

Knapp did not, therefore, give cyclodialysis anywhere nearly as fair a trial as Gradle did in his selected cases.

Elliot (6) says, "Combining cyclodialysis with trephining is making a retrograde step".

In 1903, according to Elliot (5), major Herbert communicated the results of 130 operations for the production of a subconjunctival prolapse of the iris in primary non-congestive glaucoma. He found the relief of tension more certain and permanent and the effect on vision more favorable than that of iridectomy.

In 1907, Holth advocated a procedure somewhat similar to that of Herbert. This operation requires a complete iridectomy and one of the pillars is drawn into the wound and becomes incarcerated. Filtration takes place alongside this tissue. Holth at first reported 41 cases with 85% conjunctival oedema and later 87 with 86 filtering cicatrices. He claimed not to have lost an eye. The danger of this operation was from infection or sympathetic ophthalmia. The above information was obtained from Elliot's (5) book on glaucoma.

Holth (23) said in 1932, "Post mortum histology has demonstrated subconjunctival iris fistula up to six years after iridencleisis. The subconjunctial tunnel reduces the production of subconjunctival scar tissue to a minimum".

The latter is a new feature added to his old type of operation.

Gjessing (13) operated on 152 cases of chronic glaucoma from August, 1911 to February, 1931, using Holth's iridencleisis. Of these patients 122 were reexamined from 6 to 159 months after operation, 20 of them underwent total iridectomy with inclusion subconjunctivally of one or both pillars or peripheral iridectomy with inclusion of the iris in the wound. Iridencleisis was not followed by reoperation but was done in 3 cases in which other operations had been tried and failed. The results were as follows: There was a direct detrimental effect on 3 cases, 22 operations were not quite successful and only delayed the inevitable catastrophe. The result on 2 cases was good after 50 to 75 months but at 102 to 132 months the final result was poor. The result was good at first on 2 cases and then without any visible reason both became poor. A favorable result was obtained in 83.5% of reexamined patients. This figure was obtained by averaging the results of tension, vision and field of vision.

1. 87.7% of cases the tension was normalized.
2. 79.5% of cases the vision was unaltered or even increased.
3. 83.2% of cases the field of vision remained the same or even increased.

Gjessing (13) obtained the best results when the operation was done early. He believes, "Holth's iridencleisis,

especially when combined with meridional iridotomy gives a relative certain and lasting result without exposing the eye to considerable risk later".

Greenwood (21) reports that Wilmer had 87.4% success in 517 iridencleisis operations. Late infection followed in 0.38% of the cases. Greenwood also quotes Butler as saying, "The only real objection to iridencleisis is that its effect is slow, and if after care is not carried out conscientiously the filtration may become ineffective". Greenwood, himself, says, "The operator who perfects himself in carrying out a well performed iridencleisis with a small sclerotomy is also fairly sure of a safe operation for all cases".

Robertson (35) states, "Iridencleisis is easier to perform and less dangerous than Elliot's trephining and the results appear equally as good. Certainly late infection is much less frequent".

To quote Gifford (12), "A special indication for using iridencleisis is when the field is cut down to the fixation point as the anterior chamber fills more rapidly".

The review of some of the literature on iridencleisis has impressed me as to the usefullness of this operation in treating chronic glaucoma of the non-congestive type. There are, however, many criticisms of iris incarceration by eminent ophthalmologists. Their views on iris incarceration will be presented after the following discussion

of the iridotasis operation.

Iridotasis advocated by John Barthen is somewhat similar to the Holth operation. Barthen established sub-conjunctival prolapse without previous iridectomy. He claimed, according to Elliot (5), that in no case of simple glaucoma did he fail to obtain the desired results. He based his opinion on 50 operations, the results of which were published in 1909.

Rutherford says Wilder does an iridotasis operation as follows, "A conjunctival flap is made like that in trephining but not as wide. The middle part is dissected down to expose 4 to 5 millimeters of the limbus. A keratome incision 4 millimeters long is made into the anterior chamber, one millimeter behind the margin of the cornea. The iris is grasped and pulled into the wound so that its posterior or retinal surface is anterior. The conjunctival flap is replaced and the eye bandaged".

Goldenburg (14) says, "Iridotasis is not a cure but merely overcomes the symptoms and controls tension better than any other operation used or seen by the writer. The technique is simple and the ability to use atropine sulfate an advantage. I, myself, since 1908 have made 426 iridotasis operations and the results have been so good that I have not attempted to use other operations when the eye has not been inflamed or the iris atrophic. In the non-congestive or simplex type the immediate results are

naturally not so brilliant. Most of the cases I have operated on have been in the very late stages". Goldenburg goes on to say, "The patients only complaint of the iridotasis operation is a pain, sticking like pins. In my opinion this is but a symptom of an excessive amount of fluid trying to escape thru the limbal wound. The antagonistic argument based on the unsurgical principle, incarceration of the iris, is not based on clinical results, which after all is said and done, is the only factor that interests the sufferer with glaucoma".

Gifford (9) says, "With a well performed operation I believe the ultimate results of trephining and iridotasis so far as tension is concerned are practically identical. In the iridotasis, however, a secondary puncture of the iris is often necessary. This operation seems simpler than trephining and is certainly an efficient way of fistulizing an eye. The chamber is also restored much more quickly following iridotasis than after trephining". Gifford (9) in 62 iridotasis operations did not have an infection.

Parson (33) states, "Deliberate attempts have been made to make a filtering scar. Iris incarceration in the wound produced such a scar by impeding cicatrization. This is not justifiable as there is a risk of iridocyclitis, secondary infection of the eye, and sympathetic ophthalmia. The incarceration of a silk thread or other drain in the

wound is even less justifiable".

Thompson (39) says of iridotasis, "Good results have been reported and no doubt have occurred, but when one has seen infection through the conjunctiva of an incarcerated iris, one is not apt to risk it even though its occurrence is infrequent".

Snyder (37) states, "The iridotasis lacks the authority of prominent operators although it is spoken of well by certain men".

Knapp (26) performed an iridotasis in 5 cases. In all of these the tension remained low. "Iridotasis was done because it was so highly spoken of and a good result was secured in those few cases".

Curran (2) says, "A small peripheral iridotomy should be the operation of election in all primary simple glaucomas including its acute attacks in the course of the disease because of its safety from intra-ocular hemorrhage and because it puts an eye in good condition for subconjunctival or subchoroidal drainage, if found to be necessary later. It does not alter the appearance of the eye".

The complications which might arise during an operation for glaucoma are nicely outlined by Elliot (5) and are as follows:

1. Button-holing or injury to the flap. This may occur during any sclerectomy operation.

2. Loss of the disc in the anterior chamber in a trephine operation. This happens in 1.6% of cases. A gentle stream from an irrigator will in most cases quickly wash the missing piece of sclera through the hole to the outside. If, however, it is left behind it may do no harm whatsoever.

3. Loss of vitreous. This does not often occur in operations for simple glaucoma.

4. Intraocular hemorrhage. To avoid reduce to a minimum the aperatures in the tunics.

5. Superficial hemorrhage. This may be controlled by adrenalin.

6. Plugging of the wound by intra-ocular contents. Attempt to replace them. Leave none in wound if possible.

7. Wounding of the lens. Cataract usually follows.

The late complications arising after operation, principally the trephine, for glaucoma were also well discussed by Elliot (5):

1. Shallowness of the chamber. It usually deepens after an interval. It may be due to small fistulette. If so, cauterize with 2% silver nitrate.

2. Displacement of the flap. This can not occur if the flap is sutured at the time of operation.

3. Blood in the chamber. May be avoided by bandaging after instilling atropine sulfate.

4. Post operative iritis. May be due to posterior synechia. To avoid use a mydriatic on the second post operative day. It may, however, be due to a continuence or an exacerbation of an acute or subacute iritis. If this is true it is treated as an ordinary iritis.

5. Septic conditions due to contamination at the time of operation. Whether or not this occurs depends less on the particular method employed and more on the preparatory technique.

6. Prolapse of the uveal tissue into the operation wound during healing. This rare condition is due usually to the patient squeezing the eye. If prolapse of the iris occurs it should be incised and replaced by irrigation.

7. Dislocation of the lens or vitreous body. This may be due to increase in the volume of the vitreous body, fluid lens or rupture of the suspensary ligament.

8. Early recurrence of an increase of tension after operation may be due to:

   a. Failure to enter the anterior chamber freely at the time of operation.

   b. Failure to remove a large piece of Desemet's membrane.

   c. The blockage of operature by uveal tissue, lens, vitreous, sclera or by proliferation of inflammatory tissue. To reduce the tension one may do an iridectomy, cyclodialysis, sclerotomy or trephine.

9. Detachment of the choroid. Fuchs thinks it is due to rupture of the ligamentum pectinatum. Gifford (9) said it occurred in about 20% of his cases following trephining. It is not serious. All that is necessary is to keep the patient quiet.

10. Defective vision may be due to:

   a. Advance of the lens system. Refilling of the anterior chamber restores sight in this case.

   b. Minute quantities of blood in the aqueous.

   c. Wrinkling and striate opacification of the cornea due to hypotonus. This leaves as eye refills.

   d. Retinal changes. This usually occurs in late cases.

   e. Choroid detachment.

11. Late infection. This, according to Elliot (5), does not include those infections which commence

from the first to third week after operation. The factors required are:

a. An infection of the conjunctiva.

b. An abrasion of the surface of that membrane to provide an entry for septic organisms.

c. A suitable path along which such organisms may travel to reach the interior of the globe.

d. A deficiency in tissue resistance to the onslaught of that particular organism.

Elliot (5) says, "A late infection is the transmission across a filtering scar, of septic organisms, which have obtained a foothold on the conjunctiva, and which on passing into the interior of the globe give rise to a more or less severe form of uveitis. The form of scar which filters longest and most freely will be the most liable to be the seat of a late infection. This is the very scar we are aiming to produce. Late infections in addition to following corneo-scleral trephining also have followed Lagrange's operation, Herbert's sclerectomies, Holth's punch forceps operation, cataract extraction and even iridectomy. H. Gifford attributed the immunity of Lagrange and Elliot to late infection, to their technique of using thick flaps".

Lagrange and Elliot each has had large operative experiences and neither has had a late infection.

Kirkpatrick's experience in trephining according to Elliot is numerically one of the largest in the world. In all of his experience he cannot recall a single case

of late infection.

Wilmer had the opportunity of seeing four of the eyes he had trephined suffer from acute and dangerous conjunctivitis during a local epidemic without one of them developing a late infection.

Elliot (5) says to avoid late infection:

1. Form flaps with thick bases.
2. Protect an operated eye from injury by using every means in our power.
3. Impress the patient as to the necessity of remaining for some time under medical supervision and to look upon any catarrhal condition of the conjunctiva as serious.
4. Keep in touch with every trephined eye as long as catarrh is present.

SUMMARY

Patients with chronic non-congestive glaucoma must be kept under ophthalmological surveillance for the rest of their life.

General treatment is very important. Foci of infection must be done away with and the patients life so regulated that stress and strain are avoided.

Careful and frequent taking of the patients intraocular tension, vision and visual fields furnish the best means of judging the effect of therapy.

The time honored drugs, eserine and pilocarpine, are still considered to be among the most effective of the non-surgical treatments.

The use of adrenalin, especially Gradle's adrenalin pack, has a place in simple glaucoma therapy. The pack is often used to give eserine a start and to prolong its effect.

Hamburger's glaucosan is spoken of highly by some and criticised by others. The use of eserine before the instillation of glaucosan as advocated by S. R. Gifford has nearly done away with the not infrequent preliminary acute rise in intra-ocular tension.

Many other drugs such as calcium, pituitrin, ergot, etc. have very little effect on claucoma simplex.

When to operate is still a point of controversy. Some surgeons contend that every chronic non-congestive glaucoma is an operative case. Other surgeons delay operation as long as drugs control the glaucomatous condition.

Most ophthalmologists agree that iridectomy is of no value in the treatment of chronic non-congestive glaucoma. A few surgeons, however, say that is is of value if the fields are not markedly contracted, good vision is present, say 20/30, tension is not well controlled by miotics and a moderately deep anterior chamber remains.

Many surgeons like the Lagrange operation but usually prefer the very similar corneo-scleral trephine. This latter operation is of course a classical operation for simple glaucoma and is widely used. The good results following Elliot's trephine operation are relatively high.

The chief criticism is the possibility of late infection.

The cyclodialysis operation seems to give very good results if the cases are selected.

Holth's iridencleisis operation is also popular with some ophthalmologists, especially Gjessing, in whose hands the operation has been highly successful.

Iridotasis, as a surgical measure for the control of glaucoma simplex, is also widely and successfully used. The criticism centering about this operation and the iridencleisis operation is that of iris incarceration. It is pointed out that an incarcerated iris sometimes becomes infected.

Parsons is emphatic in his statement that any operation is contraindicated if the vision in an eye is reduced to the fixation point.

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